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Vol. 2, No. 9 SEPTEMBER, 1920 Old Series Vol. xviii, No. 9

The Journal of Orthopædic Surgery

TRAUMATIC OSTEOMYELITIS AS SEEN DURING THE WAR

EDWIN W. RYERSON, M. D., F. A. C. S. CHICAGO, WITH THE COLLABORATION OF MAJOR JOHN P. BEESON, M. C., U. S. ARMY

More than two thousand cases of infected bone-wounds have been treated in U. S. Army General Hospital No. 28, Fort Sheridan, Illinois, since January first, 1919. These wounds were received in action at some period before the armistice, and are therefore to be considered chronic. In most cases they had existed at least six months before coming under the observation of the writers of this paper.

They may be roughly divided into two classes: those with severe and serious infection, and those with slight but persistent discharge from small sinuses, without severe constitutional disturbance. Primary debridement had in all cases been performed, and there had usually been at least three or four secondary operations for drainage or the removal of sequestra before they arrived at Fort Sheridan.

No reference will here be made to cases of ununited fracture, since this subject is not included in the present symposium, but the majority of cases of chronic osteomyelitis resulted from gunshot fractures which showed bony union at the time of entrance into General Hospital 28.

Patients with severe and serious infection were admitted to the surgical service, where they were treated by the Carrel-Dakin method, or by packing with Dakinized gauze, or, in some instances, by hot wet boric acid dressings. It was the general impression that the Carrel-Dakin method, carried out with the most painstaking attention to details, gave remarkably good results, and fully justified the enormous expenditure of time and labor which it invariably requires. It cannot be done properly except by espe-

cially trained and enthusiastic surgeons, and its technical and economic difficulties are such that it is sometimes unattainable. A very reliable substitute, in times of stress, was the practice of packing the wounds with gauze saturated with Dakin's fluid, after walling off the surrounding skin with vaselined strips of cloth. The wounds cleaned up rapidly, and healing progressed almost as well as under the Carrel technique. Both of these methods seemed to give better results than the wet boric acid dressings.

Most of the cases required operation of some kind, usually for the purpose of removing sequestra or foreign bodies, or to provide proper facilities for drainage. It was at first somewhat difficult to account for the very large percentage of patients with sequestra, and it was considered by some observers that the primary debridements had not been done with sufficient thoroughness, but it was later realized that most of these sequestra were due to necrosis of the ends of the bones with subsequent separation of small fragments.

In general, the severely septic cases cleared up rapidly, and were able to be discharged in a comparatively short time. The X-ray examination, carried out in all instances, was of the greatest value in determining the plan of treatment.

The cases of the second arbitrary class, with wounds entirely healed except for one or two small, persistent sinuses, were of very great interest. Many of them had been considered as healed with superficial ulceration, and the original bone injury had been forgotten, but it was astonishing to note the regularity with which the routine X-ray examination revealed definite deep pathology underlying the shallow ulcers.

More than seventy per cent of this class showed sequestra, a few had foreign bodies, chiefly shell-fragments, as the irritants, and approximately forty per cent had cavities in the bone which were incapable of permanent healing. Many of these latter also had sequestra within the cavities.

It soon became evident that all of these cases required operation, the sequestra and foreign bodies being obviously undesirable, and the cavities needing the special forms of treatment described by many surgeons overseas and popularized by such men as Dehelly, Depage and Chutro. This means, in effect, that the overhanging walls of the cavity must be cut away to such an ex-

tent as to leave only a shallow, saucer-like depression, into which the soft tissues can be made to fall. It may be necesary to remove a considerable portion of the cortex, even to the extent of materially weakening the structure of so important a bone as the femur, but experience has shown that sufficient bone growth will eventually take place to provide enough strength. This method, in the cases for which it is suitable, is extremely satisfactory, but there are many instances where it cannot be used, as, for example, in the immediate neighborhood of the joints. Here it would be impossible to remove the walls without opening into the joints, and some other method must be used. The transplantation of free or pedunculated masses of fat, sufficient to fill up the entire cavity, has been recommended by some authors, and it was tried in a series of cases at Fort Sheridan. It did not give good results, and has been abandoned by the writers of this paper. The best and most reliable method, in our experience, is the use of pedunculated flaps of healthy muscle, cut with as broad a base as possible, in order to provide sufficient blood-supply. These muscle-flaps have good resistance to infection, and rapidly become adherent to the walls of the bone-cavity. Several cases were observed where the lower end of the femur had been the seat of severe damage, one side having been shot away just above the condyle, with an osteomyelitis involving most of the epiphysis, but not extending into the joint. Here, obviously, no more bone could be removed at the lower margin without ruining the joint. The bone-cavity was therefore packed with Dakinized gauze until the bacterial count was reduced to a minimum, and a large flap of the vastus muscle was turned down and pressed into the cavity. It was fastened as well as possible by suturing its neck to the surrounding tissues, so that it could not retract, and the skin was loosely sutured over it. Drainage was always used. Considerable suppuration generally took place, but after a time complete healing resulted.

It is probable that this method should be more widely used in other portions of the bones, especially in the femur and tibia, since it would reduce the liability to fracture either during the operation or afterward, by rendering it unnecessary to remove important cortical bone.

Much interest has been aroused by the work of W. W. Babcock on the immediate sterilization and closure of chronic infected

wounds by the use of zinc chloride in connection with radical excision of the infected area. His results, as published in the Journal of the Am. Med. Assoc. of May 8th, 1920, certainly furnish a strong argument for the more extended trial of the method, but up to this time it has not been attempted by the writers.

Case Histories

O. S. B. X-ray No. 4122, wounded by M. G. B. Sept. 28, 1918 in left thigh, with fracture compound, femur, upper third. Admitted to GH28 June 20, 1919, with union, limited motion in knee and a discharging sinus. Operated July 14, 1919, sequestrectomy and bone saucerized. Did not heal and was re-operated March 13, 1920, old scar and sinus tract excised and bone again saucerized. Healed May 3, 1920 and was discharged May 25, 1920, with one inch shortening, knee flexion 45 degrees.

O. B. X-ray No. 5207, wounded Oct. 12, 1918 in right arm, fracture compound, humerus middle third. Admitted to GH28 Nov. 15, 1919 with union and discharging sinus. Operated Jan. 8, 1920, sequestrectomy, bone saucerized and muscle sutured into bottom of cavity. Still draining slightly June 1, 1920 but shows all signs of healing soon.

C. S. X-ray No. 2151, wounded Oct. 6, 1918 by M. G. B. through ankle. Admitted to GH28 April 9, with discharging sinus from internal malleolus and bony ankylosis of ankle. Operated June 5, 1919, tibia saucerized, external condyle and astragalus removed. Healed Dec. 26, 1919. Discharged March 25, 1920 with foot in good position and 15 degrees of movement in ankle.

A. H. T. X-ray 5037, wounded Sept. 28, 1918. With fracture, compound of femur, upper third. Admitted to GH28 July 28, 1919 with union, large draining sinus outer side of thigh. Knee fixed in 20 degrees flexion. Operated Aug. 16, 1919 sequestrectomy, bone saucerized. Discharged May 1st, 1920 with one inch shortening, movable knee, to 45 degrees flexion.

F. R. X-ray 1889, wounded Oct. 4, 1918, M. G. B. left thigh, fracture compound, femur middle third. Admitted to GH28 April 9, 1919 with union, discharging sinus posterior surface and stiff knee. Operated June 6, 1919, sequestrectomy and bone saucerized. Healed Feb. 23, 1920; discharged April 7, 1920 with no shortening and knee flexion to 110 degrees.

A. R. X-ray No. 1507, wounded Oct. 10, 1918, M. G. B. thru left leg, with fracture, compound, tibia, lower third. Admitted to GH28 March 25, 1919 with union, 2¼ inch shortening and discharging sinus. X-ray shows union of proximal fragment of tibia to distal fragment of fibula. No union of distal fragment of tibia. Operated Aug. 1, 1919, sequestrectomy and bone saucerized. Healed Dec. 30, 1919. Discharged May 11, 1920 with 20 degrees motion in ankle, and foot in good position.

J. J. P. X-ray No. 5615, wounded Oct. 4, 1918, M. G. B. right leg with fracture, compound tibia and fibula. Admitted to GH28 July 28, 1919 with union and discharging sinus. Operated Oct. 13, 1919, tunnel in bone exposed and roof removed and bone saucerized. Healed Jan. 17, 1920 with large adherent scar. Discharged Feb. 4, 1920, one-half inch shortening, no limitation of motion in joint.

All these cases had at least 4 previous operations before coming to Ft. Sheridan—primary debridement, and secondary sequestrectomies, etc.

DISCUSSION OF PAPERS BY DR. RYERSON AND DR. KIDNER*

DR. GAENSLEN: It certainly seems advisable to be on the alert for syphilis in all atypical cases. I recall two or three cases with unusual symptoms that came on gradually, with moderate temperature, pain and restlessness at night. One got the impression of a very mild osteomyelitis. I had one such case under observation, with involvement at the upper, outer end of the femur. Before I recognized the true nature of the lesion I had fixed the hip in plaster, because it seemed to represent a different type of case. Under fixation treatment, pain and temperature subsided, and the general condition improved. Later on there was multiple involvement of the metatarsal bones of the feet. The Wassermann test was found positive and mixed treatment was followed by marked improvement.

DR. RUGH: There are two points to be noted in these papers; first: I noticed that many men who were drawn into the service, had been apparently cured of osteomyelitis for from three to ten years. These were chronic non-tubercular cases, which are generally considered cured when the sinus is closed, but when these men were put on intensive work the old sinus broke down. In other words, there is very little difference between tubercular osteomyelitis and the other suppurative forms. Second: I have not looked up cases like Dr. Soutter's, but I have seen two cases of primary osteomyelitis of the patella,—one in a boy, evidently of traumatic origin, the other in a woman of 22 years of age. The diagnosis was made after the X-Ray picture was taken. Sometimes this condition resembles a bursitis, rather than an osteomyelitis. In my two cases, one was operated upon and one was treated by fixation in plaster.

DR. ORR: There is one point in technique which it is important to emphasize. In getting a good field for saucerization, I have often seen the retractor put under the bone in such a way that a pocket is left on the far side.

*Dr. Kidner's paper was printed in the August issue.

With a septic field there is likely to be a development of suppurative foci if this is done. One should be careful not to use retractors in this way.

DR. PECKHAM: I have seen two or three cases of osteomyelitis unsuccessfully treated by the Carrel-Dakin solution afterward cured by ionic medication. In a two per cent solution of zinc sulphide there exists free ions of zinc, attracted toward the negative pole. Therefore if you apply zinc solution from the positive pole it is attracted toward the negative, the wave is between the two poles. These statements can be easily verified. These ions kill bugs and this can be followed under the microscope. If you saucerize your bone, and put a large electrode opposite the opening and a small one in the opening you can send a current through and the electricity kills everything. I have done this with success. You then operate and clean out your wound and make it dry. I have done the sliding skin flap and this obliterates all the spaces. Your case is then cured, (if you are successful).

DR. STARR: I would like to say a few words on the point I made yesterday in the clinic. Dr. Kidner made a suggestion as to the method of introduction of infection into the bone. One reason why this subject should be discussed is that when we were getting up this symposium we wrote to several of the members to ask them to discuss the subject of acute osteo-myelitis, and we had at least a dozen refusals; the reason stated was that they didn't know anything about the subject. Therefore it is up to some of us to make a few observations. You can take any joint, such as the knee, that is a fairly common source of the infective process, this diagram shows the epiphyseal line with the periosteum inserted into the epiphyseal line, limiting the extent of the infection. For some unknown reason, the infecting osteomyelitis starts on the diaphyseal side of the epiphyseal line. Trauma is a difficult thing to lay one's finger upon, but this may be a reason why the blood stream lodges the infection in one joint rather than another. It does do so on the diaphyseal side, close to the cortex. The infectious process extends rapidly from this point. The diagnosis should be made within the first 24 hours. There is nothing else except cellulitis that simulates this condition. There is high temperature, high leucocytosis and marked pain with localized tenderness. The patient is severely ill. This condition would never occur except in osteomyelitis. You must relieve the tension and prevent infection from spreading into the cancellous tissue of the bone, and thus prevent the bone destruction. If the case is not diagnosed, the infection spreads through the cortex to the periosteum and this is raised. The medullary cavity is 2 or 3 inches above the line of infection and does not become infected for some time. Having found the localized point of tenderness, you relieve tension by a simple incision which will relieve pus, and a drainage tube put in then will stop bone destruction. If the case goes on for four or five days there is a large amount of pus under the periosteum. This causes destruction of the cortex and blocks off the blood supply, by obstructing the vessels. The question is what to do with these cases. It is difficult at operation to differentiate normal from abnormal tissue; you may leave infected tissue, or you may take healthy tissue away. If you have an extensive stripping of the periosteum with drainage, leave it alone until it has formed a sequestrum, then the involucrum forms of itself on the outside and the sequestrum is freed. Removal of the involucrum will expose the cavity and the sequestrum. You can wipe out the cavity and the wound will heal within three or four weeks. If it is more extensive, still leave it alone until the sequestrum has come away. If there is complete stripping of the shaft, so that the shaft is separated, it should be left alone until involucrum is formed, and then it can be removed. The subsequent recovery of the shaft will come from the stripped periosteum. New bone is regenerated from this periosteum so stripped, which carries with it some osteoblasts as a result of the inflammatory changes. The teaching of the text books is pernicious on this point. If you cut down to the periosteum and find no pus, the text-books urge you to go on, but you may find no frank pus anywhere along

the line, at any time; you should only incise until you relieve the tension. When you don't find anything, a few drill holes can be made in the section toward the epiphysis, thus establishing a line of least resistance, so that the infection will not spread to the medullary canal. The medullary canal in the early cases should never be chiselled into or otherwise opened up.

DR. RYERSON (closing): It was to be expected that Dr. Peckham would spring something electrical upon us. I should not want to have my wounds Peckhamized. The cases I have mentioned are infected wounds of the bone and should not be treated as acute osteomyelitis. What our president has said about conservatism in the treatment of acute osteomyelitis is right. We have seen whole tibias and fibulas removed with the idea that new ones would grow. We have seen brand new tibias grow from something that was not the shaft of the tibia. I won't say the periosteum did it; but something did it! In acute cases we must drain; we must cut down at least to the periosteum. Dr. Starr says to drill the bone, but I should prefer to have a larger opening made when the X-Ray shows destruction in the shaft. I believe it is not wise to allow soldiers' wounds to suppurate if one can safely close them, on account of the possibility of amyloid degeneration. Cavities must be closed by filling in with soft tissue. Some men use skin, but I don't believe in it. It does not allow the bone to grow. I think soft muscle tissue is much to be preferred. I have seen several cases of Brodie's abscess. The patient has no external signs, and the X-ray shows slight rarification. The characteristic is in intense boring pain at night. I do not believe in Dr. Stern's method of scraping out. You do not need to take out every bit of osteogenetic material. The cavity can be gently cleaned out; then use the Carrel-Dakin method; then transplant muscle to fill the hole in the bone. The soft tissue filling will bring about healing of the abscess.

DR. KIDNER (closing): I agree with Dr. Ryerson, I do not want to ignore periosteum. I believe it does help in bone growth. Wide drainage and rest are the two things that cure osteomyelitis. Dr. Starr's drawing is a classic which should come before the whole country. Surgeons are everywhere cutting away too much bone in the attempt to find pus. I have not seen amyloid degeneration among soldiers. The less curettage one does within a bone cavity, the better the chance of regeneration.

DR. SOUTTER: In osteomyelitis I agree with Dr. Starr that a sequestrum should not be removed until it has separated or has practically separated from the rest of the bone. The bone should be opened but not scooped out its entire length as is sometimes recommended.

In osteomyelitis, a great deal of the repair is helped by a good involucrum and the support which comes from the bone that will later separate and become sequestra.

The soft tissues should always be well drained down to the bone so that they do not become soaked with the discharge and lifted from the bone.

DR. STARR: There are two points to be emphasized: there is danger in cleaning out the cavity too much. You have seen men curetting with absolutely no knowledge where the pathological tissue ends and the healthy starts. In filling up a cavity of that sort, muscle has a distinctly bactericidal effect in these cavities. Fat, in my experience, has proved useless.

PAIN IN THE GREAT TOE FROM ADHESIONS OF THE INTERNAL SESAMOID BONE

BY ROLAND HAMMOND, M. D., PROVIDENCE, R. I.

This is a report of two cases of pain in the great toe which proved in both cases to be due to adhesions between the internal sesamoid bone and the head of the first metatarsal bone. In both cases the pain was relieved by the removal of the sesamoid bone. In the first case the pain was felt on the internal surface of the first toe from the metatarso-phalangeal joint forward to the end of the toe; in the second case the pain was felt on the under surface of the first toe when bearing weight and was localized at the metatarso-phalangeal joint.

CASE 1. J. M., school teacher, was first seen July 2, 1918, referred by an orthopedic colleague. Two years before she had been treated for metatarsalgia with relief. Arch supports had been omitted and she had had no trouble until the autumn of 1917 when she began to have pain on the inner side of the right first toe. The toe was tender to pressure from the internal but not from the inferior surface. Examination otherwise was negative. X-ray plates showed bipartite sesamoids in both feet, and in addition a small area showing loss of bone just behind the head of the first right metatarsal. Within a week after her first visit the writer was ordered into active military service and the patient was transferred to Dr. Frank E. Peckham for further treatment. Proper shoes were prescribed, anterior arch supports were applied, and baking, electrical treatments and vibration were given without appreciable relief.

On returning to civil life one year later, the suggestion was made by Doctor Peckham that an operation upon the sesamoid bone might give relief, and concurred in by the writer.

OPERATION, JULY 8, 1919. Under a tourniquet a two-inch curved incision was made on the latero-inferior surface of the right first toe and carried down through the fascia. The tendon of the flexor longus hallucis was reflected to the outer side and the internal sesamoid bone, situated in the inner head of the tendon of the flexor brevis hallucis, was found adherent to the head of the first metatarsal bone. (Fig. 1.) Adhesions were freed up and the sesa-

moid bone dissected out. The outer sesamoid bone was found normal. Several minute, shallow depressions, slightly larger than the head of a pin, were found just behind the head of the metatarsal bone. There was loss of cartilage and the depressions were filled with detritus. It could not be determined that they had any connection with the adhesion of the sesamoid bone to the metatarsal. The wound was sutured in layers and the patient made an uneventful recovery. Some loss of sensation in the toe was present for about two months. Three months after the operation the patient was walking without pain and has remained well up to the time

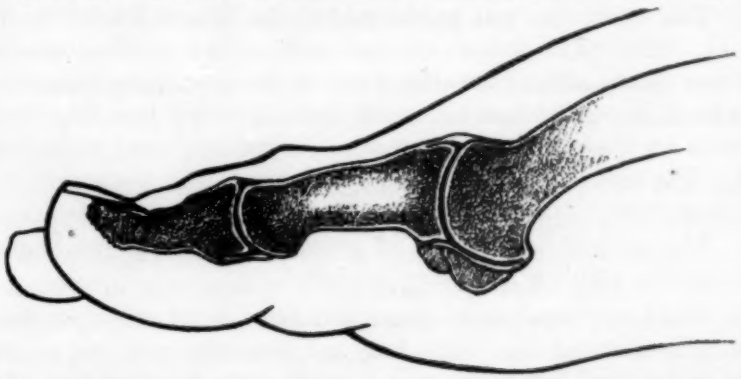

Fig. 1. Drawing showing normal relations of synovial membrane of first metatarso-phalangeal joint. In both cases the part of joint cavity between the metatarsal head and the sesamoid was obliterated and adhesions were present.

of the last examination, May 15, 1920. An anterior arch leather cuff was applied at the time when weight bearing was begun and worn for a few months, but this support has now been discontinued.

CASE 2. M. M. 31, single, entered my service at the Rhode Island Hospital October 1, 1919 with the following history:

For the past three years she had complained of a constant dull pain on the under surface of the left great toe noticed when bearing weight. There was a small tender enlargement under this toe at the metatarso-phalangeal joint, which had increased in tenderness during the past two years. No other joint involvement. X-ray examination of both feet revealed no abnormalities of the sesamoid bones.

OPERATION, October 9, 1919. Under tourniquet a two inch incision was made on the latero-inferior surface of the left first toe

with the centre opposite the metatarso-phalangeal joint. The incision was carried down through the fascia, and the tendon of the flexor longus hallucis was reflected outwards. The internal sesamoid bone was found adherent to the head of the first metatarsal bone and was dissected out. The sheath was sutured in place and the fascia and skin over it. Stitches were removed on the thirteenth day and in one month she was walking without pain.

On May 8, 1920 she reported at my request and said that she had no pain in the right foot but that she now had a similar pain in the left first toe. The same operation was advised on the left foot. This operation was performed at the Rhode Island Hospital May 13, 1920. The antero-internal side of the internal sesamoid bone was found adherent to the head of the metatarsal bone lying just above it. A minute brownish spot showing loss of cartilage was seen on the metatarsal and a corresponding area on the sesamoid. The sesamoid bone was dissected out, and is submitted for your inspection. The wound was closed as in the previous operation. The patient is relieved of pain, but has not yet begun to walk and the result cannot be reported.

It has been possible to make a dissection of one foot from a recently amputated leg. The internal sesamoid was not adherent to the metatarsal but there was a small area showing loss of cartilage in the sesamoid which was not seen in the metatarsal. It is recognized that these areas of loss of cartilage do not necessarily possess any pathological significance.

In the literature which it has been possible to consult, no reports bearing on this subject have been found. Orthopedic confreres who have been consulted have not recognized the condition, possibly owing to the writer's feeble powers of description. It is hoped that the discussion may bring out reports of similar cases.

TECHNIQUE OF AN OPERATION FOR SPINAL FUSION AS PRACTISED IN MONTREAL*

BY A. MACKENZIE FORBES, LECTURER IN ORTHOPAEDIC SURGERY, MC GILL UNIVERSITY, MONTREAL

The operation of fusion of vertebrae for tuberculosis has now been practised for some years. The methods of Albee and Hibbs are well known. I think that the first operation which was performed for spinal fusion for the treatment of Scoliosis was originally described as having been performed in the Children's Memorial Hospital in 1913.

Some of us have been using another operation, not yet described, for fusing vertebrae for the treatment of tuberculosis and especially for fusion in selected cases of Scoliosis.

The third operation was originated because of the difficulties experienced in securing a sufficiently strong union between adjacent vertebrae, especially if it was desired to get union between a large number of vertebrae where the question of leverage as a possible source of weakness, in after days, had seriously to be considered.

The operation of Albee is an interesting one. Of course it is known that the bone graft of Albee cannot, in any sense, be considered as a splint. After the investigations of Gallie and Robertson in Toronto as well as the investigations of other well known writers it is generally conceded that the function of the bone graft is simply to promote osteogenesis. The osteogenesis which it promotes is in the bone into which it is inserted. As it is inserted into the spinous processes nothing but a long bridge of bone from spinous process to spinous process can be hoped for. The weakness of this as an immobilizing agent if used over a considerable part of the spine is easily realized when the mechanical principle of leverage is considered.

The operation of Hibbs is, in the opinion of the writer, a more exact and mechanically perfect operation than that of Albee.

*The original description of this operation was read at the meeting of the American Orthopaedic Association held in Toronto during the month of June, 1920. As many questions regarding the details of this operation were asked in the discussion which followed the first copy of these notes was subjected to the criticism of Doctors Royal Whitman of New York and Fred P. Yorston, of Montreal. Many of the suggestions of these surgeons for the elucidation of details have been incorporated in the description now being published. It is, consequently, hoped that it will be easily understood.

Here the articular processes between adjacent vertebrae are destroyed by means of a small curette. Here also the contiguous surfaces of laminae are so gouged and freshened that union between adjacent laminae can be hoped for. In this operation the spinous processes are turned down by means of a special cutting forceps devised by Hibbs in the expectation that these will become united and form a bridge of bone from vertebra to vertebra.

The operation of Hibbs is hardly open to the same criticism as that of Albee. At the same time if one performs this operation in the lumbar region, which is the region in which it is especially indicated in Scoliosis, one is impressed with the difficulty of bridging between the adjacent laminae by means of elevated fragments of bone turned up from the contiguous vertebrae because of the wide expansion between these vertebrae. The same holds good in turning down spinous processes. The space between the laminae and spinous processes of the lumbar vertebrae is so great that it is difficult to bridge by the method suggested by Hibbs.

We appreciate the pioneer work done by Albee and the mechanical perfections of the Hibbs operation. At the same time we contend that the stronger the fusion obtained the greater can be our expectation of success. For this reason we have devised the third operation which we now attempt to describe:

Broadly speaking, it may be said that the lumbar vertebrae differ materially in character from the dorsal vertebrae. Because the spinous processes and laminae of the dorsal vertebrae bear a different relationship to each other than do the spinous processes and laminae of the lumbar, different treatment must be carried out in these two regions.

The spinous processes and laminae in the dorsal region lie in apposition very much as the shingles on a wall, the upper part of the superior vertebrae lying, in each individual case, more superficially than the lower one.

On the other hand the spinous processes and laminae of the lumbar vertebrae do not lie in apposition to each other. Each one stands out as a separate and distinct entity and is well separated from its fellow by the soft parts.

OPERATION FOR SCOLIOSIS

A flap of skin sufficiently long to expose the area to be operated on is reflected from the concave side as in the Albee operation. The muscles on either side of the spinous processes are separated and are retracted exposing the laminae.

The supra-spinous ligament, the inter-spinous ligaments and other tissues between the adjacent spinous processes are removed. In the case of the dorsal vertebrae the following additional steps are carried out. The spinous processes and laminae are so gouged by means of a concave chisel that their cortical layers are separated from the medulla beneath and a series of chips of bone and periosteum are pried up along the superior and inferior surfaces of these parts of the vertebrae. These chips of bone are made to interdigitate with each other thus similar cortical chips or digitations from the adjacent vertebrae are so opposed that the new bone thrown out from the raw surfaces of the exposed medulla will unite in one bridge or band extending from vertebrae to vertebrae. In other words the laminae and spines in this region are in such close apposition that the interval between them is easily bridged by pushing the elevated fragments adherent to the periosteum alternately upwards and downwards from the laminae and spinous processes thus making a form of connecting trellis.

In the case of the lumbar vertebrae the following additional technique is required, as in this region the laminae and spinous processes are more widely separated than in the dorsal region.

The laminae of the lumbar vertebrae are so gouged by means of a concave chisel that their cortical layers are separated from the medulla and pried up along the superior and inferior surfaces of these parts of the vertebrae as practised in the dorsal vertebrae.

In the case of the spinous processes as these are more widely separated the connection is made more directly by splitting them vertically into several thin sections which are forced upwards and downwards and to the sides in order to inter-lock with those from the adjoining spinous processes and laminae.

In other words the spinous processes of the adjacent lumbar vertebrae are multisected into a petal-like formation extending in a vertical direction. The layers of petals are made to inter-lock or interdigitate with each other after having been depressed laterally

and made to lie layer upon layer over the laminae of the vertebrae which have been already freshened as described.

The spinous processes of the upper sacral vertebrae receives the same treatment. The lateral masses of the upper sacral vertebrae are turned over by means of a gouge from the caudal towards the capital extremity of this bone and made to cover the space between the sacrum and the fifth lumbar vertebrae and to interdigitate with the petals of freshened layers of bone above.

The erector muscles are then united over this oozing mass of exposed medullary layers of bone after drainage tubes have been inserted to care for future oozing. The skin is then united in the usual way and the wound dressed.

The patient then is laid in the prone position on a narrow hammock and placed in the position of greatest possible correction, and in this correction maintained by means of a plaster jacket in which the patient remains for six months.

This operation is not a simple one. It takes time to complete it and there tends to be much haemorrhage through venous oozing. There may be, also, some shock.

This operation should not be undertaken lightly, although in selected cases it will be found to have a distinct place. In the Children's Memorial Hospital, Montreal, we carefully choose our anaesthetist when performing this operation and impress the fact upon him that we prefer to complete our operation at a later date, if our patient shows any suggestive danger signal. Further in the case of an operation for the arrest of a progressive lateral curvature we always insist on performing the operation on the lumbar spine at one seance and that on the dorsal spine from three to six months later.

DISCUSSION

DR. GALLOWAY: I wish to disclaim any special qualification for discussing this subject. My experience has been limited and not of the kind to make me enthusiastic. I am frankly pessimistic regarding structural scoliosis. Five years ago I had a patient of seven, with severe progressive scoliosis after polio myelitis. There was a striking degree of difference in the deformity when lying down and standing up. It occurred to me that if I could ankylose the vertebrae in the position they assumed when the patient was lying prone, I could decrease the deformity. I had had no experience with this application of the Albee operation but the parents readily consented to my attempting to improve the child's condition. The result was an enormous improvement, and prevention of increase of deformity. Since then I have operated on several cases, some by the Albee method and some by the Hibbs method. On the whole I

think the Hibbs' operation preferable for this class of cases. I don't believe results will be good unless there is considerable reduction of deformity noticeable in the prone position. My first case proved more satisfactory than any of the subsequent ones. I believe it is necessary to ankylose practically the whole of the dorsal and lumbar regions to get the best results.

DR. FREIBERG: I have no confidence in the principles of the operation for scoliosis, and so have not done any. Dr. Albee is unsound in his reasoning. However much bone you stick in the unbalanced muscles must continue their pull, and even if you convert it into a poker back you will get recurrence of the deformity. I admire Dr. Truslow's optimism. I have tried this treatment for years; I have supervised gymnastics as he has. Cases have been carefully controlled in my office. I was convinced that the patients did not do their exercises well at home. I have come to the conclusion there was no such thing as corrective exercise. Correction of the deformity by plaster jackets is not to be measured in a short time, but perhaps years afterwards. Dr. Truslow measures by percentages; my measurements are by a scale of which 50 amounts to the same thing. You can easily see how much change has taken place.

DR. ADAMS: There are many cases of severe scoliosis that are due to infantile paralysis, many more than have been supposed up to the present. Whether this operation of fusion will be successful in these cases is yet to be proved, but it seems most hopeful from what I have had the chance to observe at the clinic of Dr. Forbes. Some years ago, I convinced myself that another large group of severe scoliosis were due to anomalies of the sacrum and the fifth lumbar vertebrae. Whether this fusing operation would be of any avail in this second type of case or not, I cannot be sure, but possibly it may be.

DR. FORBES (closing): The operative treatment for Scoliosis as suggested in the paper read by me is for selected cases only. In many cases of Scoliosis no non-operative treatment can be depended upon to relieve the deformity. In other cases, in spite of treatment, the deformity continues to progress. It is to be borne in mind that the deformity of Scoliosis in some cases is secondary to congenital and other lesions. The English School has drawn our attention to the number of cases of Scoliosis which are secondary to congenitally wedge-shaped vertebrae. Dr. Z. B. Adams of Boston has, amongst others, drawn our attention to the number of cases of Scoliosis in which the deformity is secondary to a congenital difference in the formation of the two sides of the last lumbar vertebra. There are many cases of Scoliosis which can be attributed to a paralysis due to Poliomyelitis.

In the Children's Hospital, Montreal, it has been noticed that those suffering from marked thoracic deformity rarely reach an old age. For this reason one is justified in adopting any method which will stop an increasing deformity. In other words we have to be satisfied with a certain degree of deformity. We often have to realize that we cannot attain a greater degree of correction. In such cases are we not justified in fusing the vetebrae in order to maintain the correction possible?

Doctor Freiberg seems to think that recurrence after fusion is inevitable. Quite possibly he is right, but there is no reason why we should not try to get fusion if this is indicated. I do not agree with Doctor Freiberg that recurrence is inevitable if it is possible to obtain a sufficient fusion. I have endeavored to secure fusion of the whole vertebral column by the production of a strong band of bone leading from lamina to lamina and spinous process to spinous process. I realize to what great strain this bridge or band of bone will be subjected in after life. It was because of the realization of this that we originated a new operation for fusion which we hoped could be more certainly depended upon than that of either Albee or Hibbs.

Doctor Freiberg takes a most pessimistic view, viz. that no progress has been made in our studies or treatment of Scoliosis within the past twenty years. I do not agree with him. I think that we know a great deal more about the physiology of the spine and about spinal movements today than we did even ten years ago. I think that Feiss began such a study, that others have carried on, and that, today, our knowledge of the physiology of the spine is very much greater than it was ten years ago. Of course truth is eternal, but our knowledge of truth is not eternal. In the case of Scoliosis our knowledge of the truth concerning it has been increasing within the past ten years. It is for us to apply our knowledge for the relief of or to help, those who are afflicted with this deformity.

DR. TRUSLOW (closing): I think Dr. Freiberg has studied this subject more fully than many other members. As to the question whether the exercises can be done at home or not;—I feel that I cannot spend more time than one morning a week with my scoliosis patients; but my gymnastic prescription is something I am proud of. Something is added each time; but not until I am convinced that previous work is being done properly. I can tell from the way the patient goes about it if he is doing it properly at home. These patients can't pay the fees if they come every day and would become discouraged at the expense. The question of measurement is a personal matter. What I present is easily made, quickly recorded, and valuable for deductions. I do not think rotation is always compensated by deformity elsewhere. One can with care bring about improvement in cases with as much as 25 per cent of rotation. It is true that these patients may die early, but with properly graduated exercise one can note improvement in the blood pressure and general condition. The question of paralytic scoliosis is very important. These deformities have occurred frequently since the 1916 epidemic and this is the cause of more adolescent scoliosis than we have been aware of. I try to make my patients optimistic. They will carry on the treatment longer if they take it in this spirit.

AN END-RESULT STUDY OF ARTHRODESIS FOR NON-TUBERCULAR AFFECTIONS OF THE HIP JOINT

BY H. W. SPIERS, M. D., LOS ANGELES, CAL.

From the Orthopedic Clinic of the Massachusetts General Hospital. A review of 34 cases operated there since 1908.

Operative relief of the stiff and painful hip of Non-Tubercular origin has not been given much consideration in the literature. This series was investigated at the suggestion of Dr. Robert B. Osgood. The operative work was largely preformed under the service of Dr. E. G. Brackett, whose method of approach was most frequently used. An effort was uniformly made to destroy the joint cartilage, to approximate the raw bony surfaces and to immobilize the extremity in the position of greatest functional value.

The questionnaire was worked out to discover as far as possible what the patient himself thought of the result, the length of his convalescence and his present condition as regards disability and self-support. The examination covered the questions of ankylosis, function and position. The records of the Out-Patient Department were studied to corroborate the report of the patient and also to get the surgeon's notes recorded from time to time during the period of the patient's ambulatory convalescence. The results were classified as Relieved, Partially Relieved, or Unrelieved and, as will be seen below, all fell definitely into one of these three classes.

Tabulation of the series is as follows:

Arthrodesis preformed since 1908	cases	34
Reported and examined	cases	25
Mortality	cases	2
Average age of patients	years	46
Youngest	years	22
Oldest	years	61
Average time since operation	years	4¼
Hypertrophic Arthritis	cases	20
Traumatic Arthritis	cases	5
Gonorrheal Arthritis—died of shock	cases	1
Relieved of symptoms	cases	14
Partially relieved of symptoms	cases	7
Unrelieved of symptoms	cases	4

REPORTS OF PHYSICAL EXAMINATIONS.

Union firm	cases	17
Union questionable	cases	3
Non-Union	cases	5
Permanent flexion—varying from 10 to 60 degrees	cases	20
Abduction retained	cases	3
Neutral position	cases	4
Adduction assumed	cases	18
Rotation internal	cases	4
Rotation neutral	cases	5
Rotation external	cases	16

A study of the results of this series shows that there was a mortality of 5.9%. One case, a boy of 22 years with gonorrheal arthritis, died of shock shortly following the operation. The other case was that of an aged man who succumbed to pneumonia at the end of two weeks. The unusual gravity of operative interference in lesions in and around the hip joint is well recognized and the fact that the average age of these patients was 46 years, many were over 50, and, too, that complicating conditions were frequent does not make this mortality seem too high.

Ankylosis seemed to be attained most readily in those whose hip pathology was due to definite trauma. The five cases that come under this group all gave what was considered as a satisfactory end-result. These cases were found relieved of their symptoms and pursuing a gainful occupation. One of this number required a second operation due to an accident that occurred during his convalescence but in spite of this was found five years later, working as a laborer and having no symptoms referable to the hip.

The individuals operated upon for the relief of disability due to Hypertrophic Arthritis do not show so good a record. Of the 20 cases, 9 were relieved, 7 were partially relieved, and 4 unrelieved. The partially relieved group themselves around those who had doubtful union. The unrelieved all frankly did not get union. It would seem therefore, that if the ankylosis aimed at is attained, the end-result will be satisfactory. On the other hand, if the ankylosis is only partial, the relief will be doubtful. This type of arthritis is characterized by ebonization of the articulating surfaces and by its failure to produce union. It would seem, that if

the percentage of failures is to be reduced, a more thorough, radical, and destructive procedure must be carried out and the post-operative immobilization must be more prolonged in this type, than in arthritis of traumatic origin.

An effort was made to estimate the length of convalescence in these cases. One reported that he went to work in four months, a few were confined from five to seven months, but the remainder, where a satisfactory estimate could be made, were from seven months to a year or more in returning to their usual means of livelihood. It was interesting in going over the records in the Out-Patient Department that several complained that their results were unsatisfactory at the end of about one year, but reported relieved at the end of from two to five years. This is taken to mean that the ankylosis was only partial at the earlier date and consolidated later. The X-ray study of a number of these cases was not very satisfactory. The writer does not feel that much can be definitely said from the study of radiographs, concerning doubtful ankylosis in hip joints where bony over-growths are the rule.

The reports of the physical examinations are interesting. The extremity was immobilized in abduction at the time of operation and was held as far as possible in that position through the convalescent period for varying length of time. High double plaster spicas were used during the first weeks, followed by the single spica for the ambulatory fixation. In spite of this, only three of the series could be definitely said to be in abduction. The degree in these was only slight. Whether or not this was due to the fact that these were individuals who must, as soon as possible, be discharged from the wards and made more or less self-dependent, can not be said. There was undoubtedly a tendency to shorten the period of complete immobilization. Four cases showed the neutral position, the remainder, eighteen cases, were definitely in adduction. Regarding rotation of the limb, the report shows that the external position was retained fairly well. Only five were in the neutral position, four in internal rotation and the remainder, sixteen, in varying degrees of the external position.

The conclusions that seem justified from a study of this series are:

1. Arthrodesis for painful hips of traumatic origin gives a satisfactory end-result.

2. Arthrodesis for painful hips of Hypertrophic Arthritic origin are less satisfactory but justified.

3. The time of convalescence is a long one, approaching one year.

4. The tendency of the extremity is to return to the position of adduction and little should be promised in this regard.

AN OPERATION FOR THE RELIEF OF MEDIAN ANAESTHESIA

BY R. I. HARRIS, M. B., TOR. MEDICAL OFFICER, DOMINION ORTHOPAEDIC HOSPITAL. JUNIOR SURGEON, HOSPITAL FOR SICK CHILDREN, TORONTO.

In a considerable percentage of the peripheral nerve injuries received during the late war, it has been difficult or impossible to perform nerve suture, because of the excessive amount of tissue destruction. In such cases so large a gap exists between the ends of the severed nerve, that it is impossible to bring them into apposition. The outlook for recovery of nerve function is, of course, hopeless, and the patient must look in other directions than nerve suture for the relief of his disabilities. Secondary operations aiming at the removal of paralysis by tendon transplantation, have given splendid results in certain types of nerve injuries, notably irreparable musculo-spiral injuries. It would seem as though such secondary operations offer the only hope of improvement to the above mentioned type of patient. For this reason it is considered of interest to publish notes of a case of irreparable median injury, in which considerable improvement was obtained by means of a secondary operation.

Pte. C. was wounded in the left forearm on Sept. 2, 1918. He was admitted to the Dominion Orthopaedic Hospital, Toronto, on March 25, 1919—6½ months after receiving his wound. At that date his wounds were healed. The bullet had penetrated the forearm from front to back, severing the median nerve and fracturing the ulna. There was a non-union of the ulna at the site of injury, with loss of about an inch of the shaft. Examination of the median nerve showed all the signs of a complete section below the level of the fibres to the forearm flexors. These retained their voluntary power, and responded to faradic stimulation. The opponens pollicis was completely paralysed, and did not respond to faradism. An interesting anomaly of innervation was present. The superficial head of the flexor pollicis brevis, instead of being supplied by the median nerve, received its nerve supply from the ulnar nerve. It possessed voluntary power, responded to faradism, and contracted when the ulnar nerve was stimulated by faradism at the elbow. Because of the insertion of this muscle into the outer

sesamoid bone at the metacarpo-phalangeal joint of the thumb, he was able to oppose the thumb to the fingers, in spite of the paralysis of the opponens pollicis. The median area was completely anaesthetic. Trophic and vaso motor changes were very marked. The whole median area was cold and cyanosed. The tips of the index and middle finger were badly ulcerated from a burn. The ulceration was more severe in the middle finger, in which the terminal phalanx was exposed.

The diagnosis on admission was therefore—ununited fracture of the left ulna, and section of the median nerve below the level of the branches to the long flexors of the fingers and thumb.

By April 15, 1919 the ulceration of the middle finger had extended so as to involve the distal interphalangeal joint. It became necessary to amputate the terminal two phalanges. This operation was performed April 17, 1919. At the same time the median nerve was explored. It was found to be completely divided about 1½ inches above the wrist. The segments of the nerve were separated by a 3 inch gap. It was not possible to obliterate this gap even by extensive freeing of the nerve and flexion of the elbow and wrist. The wound was closed without further interference. The stump of the amputated finger healed slowly and with difficulty because of the impaired circulation due to his nerve injury.

The outlook for the patient was bad. He had already lost part of a finger from ulceration following an unperceived burn. There was every reason to believe that he would continue to suffer from unperceived burns, or in winter, from frost bites. The hand was completely useless to him because of the anaesthesia of this important sensory area. There was no possibility of recovery of median function because of the impossibility of performing nerve suture. Our experience with nerve grafts for the filling in of large gaps between nerve segments has not been satisfactory, and we have abandoned this procedure. Under these circumstances there was conceived the idea of implanting the radial nerve into the lower median segment, in the hope that the fibrils of this purely sensory branch of the musculo-spiral would grown down the neurilemma sheaths of the median nerve and find new end organs in the skin of the median area. It was hoped that this would restore sufficient sensation in the median area to improve the condition of the man's hand. The anaesthesia of the radial area which

would of necessity follow, would not be serious because the area is small and unimportant. Such an operation seemed particularly suited to this patient because, as mentioned above, he still possessed the power of opposing his thumb, due to the anomalous innervation of the superficial head of the flexor pollicis brevis. Impairment of sensation was therefore his worst disability.

Accordingly, on June 19, 1919, an anastomosis of the radial nerve into the median was performed as follows: A linear incision on the dorsal surface of the lower end of the radius exposed the radial nerve between the tendons of the supinator longus and the extensor carpi radialis longus. The nerve was cut off at the level

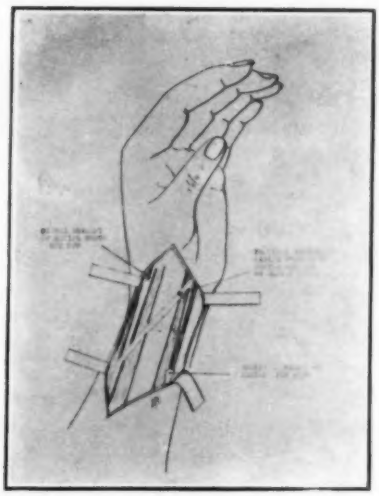

Fig. 1.

Diagram of the operation performed.

of the base of the metacarpal bone of the thumb. The lower segment of the median nerve was exposed by a second incision on the anterior surface of the wrist. It was freed and the end cut back until fresh fibres appeared. A tunnel was burrowed with Mayo scissors through the subcutaneous fat, from the upper end of the dorsal incision to the lower end of the anterior incision. Through this tunnel the radial nerve was passed. This brought the prepared ends of the radial and median nerves in contact, and rendered end to end suture easy. Suture was performed with inter-

rupted perineural sutures of fine catgut, and the site of suture was covered with a section of vein which had been slipped along the radial nerve previous to suture. The diagram explains the operative procedure.

On July 10, 1919, one month after operation, he still had complete median anaesthesia. The extent of the anaesthesia to pin prick is indicated in Fig. 2. About the middle of August (two months after operation) he stated that sensation was returning in the palm of his hand. Examination at that time appeared to confirm his statement, but the diminution was slight and no positive conclusions were drawn from the examination.

Fig. 2.

Area of anaesthesia to pin prick one month after operation.

Fig. 3.

Area of anaesthesia to pin prick 3½ mos. after operation.

On Oct. 6, 1919, 3½ months after operation, there was a definite diminution in the area of anaesthesia as is demonstrated in Fig. 3.

On Nov. 29, 1919 the gap in the left ulna was filled in with a bone-graft. From that date until March 1920 his forearm and hand were in plaster, so that progress of the recovery of the anaesthestic area could not be observed.

On March 15, 1920 (8 months after operation), there was a surprising diminution in the area of anaesthesia (See Fig. 4). Sensation had returned to the whole median area with the exception of small areas on the tips of the thumb, index and middle fingers. A curious and interesting feature was the fact that on stimulation of certain parts of the median area with a pin, the pin-prick was felt, not at the actual point of stimulation, but at the base of the thumb posteriorly, that is, in the radial area. This phenomenon was most constant on the index finger at the line

Fig. 4.

Area of anaesthesia to pin prick 8 mos. after operation.

Fig. 5.

Area of anaesthesia to pin prick 11 mos. after operation.

where the sensitive area passed over into the anaesthetic area—and this was presumably the area which had most recently recovered sensation. In the palm of the hand where sensation had been present longest, stimuli were accurately localized. Trophic and vasomotor changes had almost disappeared. There was no longer cyanosis and he no longer suffered from the extreme stasis and icy coldness which had been so bad a feature before operation.

Since March there has been a slow but steady improvement in sensation. On May 25, 1920 (11 mos. after his operation) there remained anaesthesia of only the tips of the index finger and thumb. The usefulness of his hand has greatly improved in correspondence

with the improvement in sensation. He can use the hand for the performance of all the simpler needs of daily life and there is reason to believe that if improvement continues his hand will ultimately closely approach normal.

In discussing this case it may be well to recall the conditions which exist in irreparable sections of the median nerve. Of all the peripheral nerve injuries, this is probably the worst, because the paralysis and anaesthesia involve the most used fingers. Even if the injury is below the level of the fibres to the flexors in the forearm, as was the case in this patient, there still exist two extremely damaging disabilities, viz. 1. Anaesthesia of the palmar surface of the thumb, index and middle finger and the radial half of the hand; and 2. Paralysis of the opponens pollicis with consequent inability to oppose the thumb to the fingers.

Through the sensory area supplied by the median nerve we are accustomed to receive the vast majority of our most important tactile impressions. The finger tips, and especially the tips of the thumbs, index and middle fingers, by years of training, have become highly specialized organs of touch. Through them we receive impressions of all those fine differences in the shape, texture, surface and temperature of objects, the perception of which constitutes the special sense of touch. Anaesthesia of the median area therefore means loss of the most important path of entry of tactile stimuli. As a result of the anaesthesia there are also lost all those fine movements of the fingers whose co-ordination is dependent upon tactile stimuli—for example, writing, the use of fine tools, buttoning clothes, etc. Moreover, these fingers, now insensitive and unable to protect themselves from trauma, are constantly being burned or frozen. They seem to be liable to injury by less extreme degrees of heat and cold than normal fingers, for a frosty day, which does no harm to a normal hand, often produces a bad frostbite in anaesthetic fingers, no matter how warmly they are wrapped up. The blood supply to such anaesthetic fingers is extremely sluggish, and ulceration resulting from injury is therefore extremely difficult to heal, and often leads to loss of a portion of the finger.

The median nerve normally supplies three small muscles in the hand, all associated with the thumb, and situated in the thenar eminence; the opponens pollicis, the abductor pollicis brevis, and the superficial head of the flexor pollicis brevis. Of these three,

the opponens pollicis is by far the most important. Abduction of the thumb and flexion of the thumb at the metacarpo-phalangeal joint, the functions respectively of the abductor pollicis brevis and the superficial head of the flexor pollicis brevis, are also performed by other muscles, so that in the event of median paralysis, these movements of the thumb are not entirely lost. On the other hand, opposition of the thumb, that is, rotation of the thumb about its long axis so that the pulp of the thumb faces the tips of the fingers, is

Fig. 6.

To show the atrophy of the thenar eminence due to paralysis of the opponens pollicis and the well-defined ridge formed by the belly of the superficial head of the flexor pollicis brevis.

Fig. 7.

Showing the amount of opposition of the thumb produced by the superficial head of the flexor pollicis brevis.

performed by the opponens pollicis only. In median paralysis this movement is lost. The importance of this special movement of the thumb cannot be over-estimated, since it is essential to finger tip prehension, the more important of the two types of grasping.

In a certain percentage of cases, of which the patient under discussion is an example, the fibres supplying the superficial head of the flexor pollicis brevis run with the ulnar nerve instead of with the median. As a result, when the median nerve is sectioned, this muscle retains its voluntary power, and being inserted into the outer sesamoid bone at the base of the proximal phalanx of the thumb, it is capable of producing a considerable degree of opposition of the thumb.

The accompanying photographs of the hand of the patient under discussion (Figs. 6 and 7) show this well. Fig. 6 shows the atrophy of the thenar eminence and the belly of the superficial head of the flexor pollicis brevis standing out strongly and running to its insertion in the outer sesamoid bone. Fig. 7 shows the extent to which the thumb can be opposed by this muscle. For practical purposes those patients who have a low median injury in the presence of this anomaly suffer only from median anaesthesia. They are therefore particularly suitable cases for the operation herein described.

The ease with which the brain of the patient readjusted itself to appreciate the new source of sensations is a matter of considerable interest. Until the time of operation all impulses passing up the radial nerve came from the posterior surface of the hand at the base of the thumb. After the operation a sudden change was made and stimuli from another area passed up these same fbres and were received in the brain by cells which hitherto had received impressions from the radial area. Yet in a comparatively short time the brain readjusted itself to interpret correctly the new origin of these sensations. In this connection it is of interest to note that during recovery, localization was not accurate in the area in which sensation had most recently returned. Stimuli were often referred to the radial area. Yet after a time localization became accurate in these areas.

In conclusion it may be stated that the operation described in this paper appears to offer a means of alleviating one of the worst disabilities of irreparable median injuries, viz. anaesthesia of the palmar surface of the thumb, index and middle fingers. If it only succeeds in restoring sensation to a degree sufficient to prevent unconscious burns and frost bies, it will be of considerable benefit. The approach to normal which this patient presents leads one to believe that a very considerable restoration of function is possible. The end result after the operation will be best, of course, in low median injuries, because in these, flexion of the fingers has not been lost. Function should be particularly good in those cases of anomalous innervation of the superficial head of the flexor pollicis brevis, by means of which opposition of the thumb is retained. But any case of irreparable median injury would be greatly improved by restoration of sensation.

HYPERTROPHY OF THE HEAD OF THE FIFTH METATARSAL

JAMES K. YOUNG, M. D., F. A. C. S.

Professor of Orthopedics, University of Pennsylvania Graduate School, Consulting Orthopedic Surgeon, Philadelphia Hospital.

During the last six years my attention has been arrested by a deformity of the foot which, so far as I can ascertain has escaped description.

This abnormal condition is a hypertrophy of the head of the fifth metatarsal bone, accompanied by certain symptoms which appear to be related to this enlargement. The swelling may be uniform producing a bulbous appearance of the bone when seen in an x-ray, or it may occur only on the outer side of the head of

Abnormal Foot—Note bulbous appearance cf head of fifth metatarsal and prominence on outer side of foot.

the bone, the inner side being unaffected. In either case the heads of the other metatarsal bones remain unchanged, the quadrilateral form being retained in the unaffected bones.

Atrophic changes in the head are sometimes observed as shown in the rarefied appearance of the head in Roentgen negative. The outer side of the head is prominent over the fifth, and is sensitive to pressure, and the patient complains of the friction of the shoe

Normal Foot—Note rounded head of fifth metatarsal, and straight line of outer side of foot.

at this point. The little toe is sometimes inclined inward toward the fourth, giving the appearance of deformity similar to hallux varus on the inner side of the foot, but to a lesser degree. The cause is unknown, but in the first person observed, appeared to be due to friction on the part. The patient was a young gentleman of good family, who, while a student in Switzerland, had suffered severely with the cold, and first noticed the deformity when he had rubbed his stockinged feet together for a long time in an effort to restore the temperature.

I have observed the same deformity in an Irish servant girl, whose feet were very broad, and whose muscles were powerfully developed, and in whom I attributed the deformity to the friction of too narrow shoes. The deformity, well developed, does not disappear until cured by surgical operation.

The operation I have found most satisfactory is the removal of the outer segment of the spherical head. The joint is exposed by the longitudinal lateral incision; the capsule is incised, and the outer portion of the head is removed with a curved chisel from the proximal toward the distal ends. If the chisel be used in the other direction, or toward the heel, the shaft of the bone may be split, and the healing be retarded as in one of my own cases. After the removal of the bone the synovial membrane should be closed with a subcutaneous catgut suture, and the skin with silk gut suture. A plaster cast is not necessary.

This operation I have found satisfactory, and there have been no relapses.

ARTHROPLASTY OF THE KNEE JOINT

BY PUTTI—TRANSLATED FROM THE ITALIAN BY DR. P. BLANCO.

Ollier in his early work on the knee joint was confronted with two problems: 1. Restoration of function. 2. Stability of the joint. He thought that both problems could be solved by the following methods of procedure: 1. Sufficient resection of the articulating surfaces. 2. Interposition of membrane in the joint resected. 3. Preservation of all periarticular structures, especially the ligaments. The last thing could be accomplished satisfactorily by a subperiosteal approach to the joint. This method has stood the test and is used by the author.

Pathology Present in Ankylosed Knee: 1. Changes in the bony part of the joint which cause more or less union between the articulating surfaces. 2. Changes in the periarticular tissues which per se invite the fusion of bony tissues. In an ankylosed joint, especially of long standing, all trace of capsule, ligaments, and synovia may be considered virtually gone.

With simple resection a joint cannot be reconstructed. There must be the interposition of a membrane. The result, a neo-arthrosis, resembles very much the production of ununited fracture by interposed soft parts.

Experiments on the knee joint by Segale show that the removal of capsule is followed by formation of a new capsule from the tissues immediately surrounding the joint. Therefore the necessity of preserving all the periarticular tissues. The stimulus derived from function of the joint so treated is essential in the formation of a new capsule and in the differentiation of the foreign tissue placed in the joint, into the function of synovia. Verneuil was the first one to suggest the use of muscle tissue for arthroplasty of the temporo-maxillary joint. Ollier set down the following requisites for arthroplasty: 1. Sufficient resection of bone. 2. Separation of the resected surfaces and interposition of tissue which does not ossify. 3. Methodical immobilization. Ollier in his early work on arthroplasty conceived the use of periosteum for membrane.

To get a neo-arthrosis it is necessary not only to do a simple resection of joint, but to destroy all of the intra-articular structure, namely—capsule, ligaments, and synovia.

Concerning the use of pedunculated and non-pedunculated flaps, experiments show that a piece of fascia not pedunculated introduced into a joint will grow and will resemble in many ways the histology and function of hyaline cartilage under favorable stimulus, namely, physiological function of the joint; that free fascia transplanted on resected surfaces under the worst functional conditions and environment, will be alive three years after the transplantation; that it has been transformed into a tissue much similar to that which it has attempted to replace, namely, synovia; and that it prevents the formation of new bone from the resected surface.

Indications for Arthroplasty: Success dependent upon experience of surgeon. The attitude in which the joint is ankylosed does not contra-indicate arthroplasty, but the etiology is important. Joints of tuberculous origin should be left alone regardless of a few successful cases that may be reported. (Baer, Lexer). In all other cases of ankylosis which are not tuberculous arthroplasty may be done only: 1. After a thorough clinical and x-ray examination. 2. After sufficiently long time has passed for the inflammatory condition to be completely eradicated and there is no evidence of activity in the joint itself. In gunshot wounds of joints virulent organisms may preserve their latent virulence. This is true more of the knee joint, which has a large surface and is anatomically convenient. Wait a long time for intervention: at least one year. All wounds and sinuses must be healed and there should not be any joint sensibility. Children and old people are not good subjects for arthroplasty of the knee. Best age limit from 20 to 40 years. Hypersensitive, nervous people, or those who are not interested in the success of the operation, had better be left alone. Ankylosis due to pyogenic infection of the joint is best adapted for arthroplasty. Payr thinks that fibrous ankylosis is best adapted, but this is not so, because in these cases the joint is especially tender and not able to stand the post-operative treatment. Gonorrheal arthritis is not suitable for arthroplasty because: 1. Marked joint changes, and 2. the gonococcus will remain in the tissues a long time and will flare up under slight pro-

vocation. Many of the author's gonorrhoeal cases showed typical subacute inflammation of joint following arthroplasty. Ankyloses from chronic polyarthritis are not suitable cases because: 1. Marked atrophy of muscles. 2. Poor general condition of the patient. 3. The articulating surfaces are much deformed and facetted. 4. The fascia is also atrophied and suitable flaps cannot be obtained. Traumatic arthritis is suitable.

Operative Technique: Scrupulous asepsis. Use of Esmarch bandage. Bleeding comes mostly from resected bone and scar tissue. Use modified Kocher incision. Murphy's and Payr's double lateral incision is no good because there is not sufficient exposure. The Kocher incision is prolonged below to reach around the tibial tubercle; this allows of rolling in the skin after the insertion of the patellar tendon has been removed with the tibial tubercle. The piece of bone removed should be 4x3 cm., and 1 cm. deep. Solid union of this afterwards is indispensable. Some difficulty is often found in obtaining union of this tubercle afterwards due to poor bone circulation and because only skin and connective tissues cover it. This is the weak point of the modified Kocher incision used by the author. Another procedure which may be used instead, is that of lengthening the quadriceps tendon through a curved incision. The exposure is excellent, no bone is separated, and the divided tendon heals fast. After the insertion of the patellar tendon is freed, detach the patella from the femur; then retract the skin to the inside and expose the ankylosed joint. Sometimes the joint line cannot be seen. The end of the femur and tibia should be rounded so as to approach the normal shape as much as possible; the spine of tibia should be made sharp and the intercondyloid groove deepened. Preserve as much as possible the transverse diameter of condyles, but decrease the sagittal diameter. The ankylosis is destroyed by chisel, beginning on the external condyle and working in. Do not carry chisel to posterior side of knee because of possible injury to structures in the popliteal space. Do it by manipulation. Remove enough bone so that there will be 1 cm. separation between surfaces. Smooth the resected surfaces with a file. In ankylosed flexed knees, a cicatricial mass usually grows in the popliteal space. This should be removed.

Use of Fascial Transplant: It is better to have both resected surfaces covered, although one is sometimes enough. No ad-

ditional interposition of fascia between patella and femur. Use the free transplant and not the pedunculated flap.

Concerning the Patella: Except in those few cases in which there are no adhesions to the femur, or in those cases of ankylosis with the knee in acute flexion, the patella constantly increases in thickness, sometimes twice the normal. This interferes with motion at the knee. Chisel off excess of thickness. Complete removal of patella should never be done. Before the skin is sutured, put back in place with metal nail the ligamentum patellae and tibal tubercle.

Lengthening of Quadriceps Tendon: In cases in which ankylosis is in full extension or in slight flexion, it is difficult even after resection to flex the joint; in these cases lengthen quadriceps tendon through Z-shape method.

Post-Operative Care: For fifteen days immobilize the whole leg in a plaster gutter splint in semiflexion and apply from four to five kgm. traction to the leg. This attitude of limb is the best for physiological rest. This initial immobilization is done to insure complete healing of skin wound since much of the success in arthroplasty depends on clean, rapid healing of wound. Delay in mobilization of joint does not affect result. Post operative success depends upon the interest of the patient. After stitches are removed the limb is taken out of the splint, and with strap and pulley the knee is suspended to overhead frame. The free end of the strap the patient holds in his hand. Flexion at knee by pulling on strap; extension by releasing the pull. The frequency and duration of these exercises depend upon 1. Physical strength of patient; 2, his ability to stand pain; and 3, the reaction of the joint to motion. Later on the traction is removed; the patient is allowed to sit on edge of bed, lets the limb hang out at the knee, and by gravity flexion at knee is obtained. After one month, when the tibial prominence is fixed, more intense physiotherapeutic treatment is begun; massage of whole limb, especially of quadriceps; faradism, heat, and mechanotherapy. Heat, besides relieving pain, produces hyperemia. For the use of mechanotherapy and heat combined, use Bonnet's apparatus. Besides the above treatment, automobilization is essential towards the last. Do not allow patient to walk before one and one-half months. At first, use stiff leg brace until patient has enough confidence in walking. If progress

in the range of motion is arrested, apply cast in extension or flexion as the case may be. In exceptional cases, manipulation under ether is necessary. Three months for good use of limb.

Reports on Ten Cases

Oldest, 29 yrs.; youngest, 16 yrs.; average age, 22 yrs.; largest range, 100°; smallest range, 50°; average range, 82°.

Lessons Learned from Report of Cases

1. Complete removal of all intra-articular structures is necessary.

2. The operated knee is usually larger than the other from hypertrophy of tissues.

3. Operation too soon after acute inflammation in joint has subsided means failure.

4. In gonorrheal knees with arthroplasty the post operative care should be gentle. They take longer for good results.

Book Review

The following letter from the publishers is an excellent description of the new French system on Reparative and Orthopedic Surgery.

Paris le 30 Juillet 1920

Monsieur,

Nous vous signalons que nous vous avons adresse pour compte rendu dans votre Revue le "*Traite de Chirurgie Reparatrice & Orthopedique*" que nous venons de publier.

Nous esperons que vous pourrez consacrer a cet ouvrage une analyse en rapport avec son importance et sa portee. C'est en effet *la premiere fois* que, en France ou dans le Monde, parait un ouvrage de chirurgie reparatrice ou orthopedique applique au traitement des grands traumatismes, des malformations acquises, des sequelles laissees par les accidents du travail et qu'a ces questions ont ete appliquees les methodes nouvelles elaborees pendant la guerre.

Les noms des cinquante collaborateurs, qui ont realise cette oeuvre et qui tous sont des specialistes eprouves, sont la sure garantie de la valeur de ce livre considerable qui marquera une date et un moment dans l'histoire de la chirurgie.

C'est dans cet esprit que nous le recommandons a votre attention. Nous vous remercions des maintenant de l'effort que vous ferez pour nous aider a faire connaitre cette oeuvre qui est le fruit d'un labeur collectif important, et qui resume, pour l'avenir, une experience cherement acquise.

Veuillez agreer, aves nos remerciements anticipes, nos salutations distinguees.

MASSON & Cie

Fifty surgeons, many of whom are already well known to Americans have collaborated to give us an exhaustive treatise on the surgery of injuries and functional, as well as anatomical, restoration. The work is incomplete in that almost no attention is paid to the physiotherapeutic and occupational therapeutic methods which the French, themselves, used during the war. It is exhaustive in respect to description of war and industrial injuries and their treatment by the methods of the French.

Many British and American methods of established utility seem to have been omitted or over-looked.

The second volume concludes with a valuable and interesting review of pension laws of France.

Editorial

In his presidential address before the American Surgical Association,* Dr. Brewer has suggested that there shall be a new factor in the organization of the Medical Corps of the United States Army. Account must be taken, he says, of what the Army Medical Corps required and will require again of civilian surgeons in time of war. It is proposed that an organization of civilian surgeons be made at once and that an official head of the organization be placed in the office of the Surgeon General at Washington.

Dr. Brewer takes the ground that the "Consultant" plan in the A. E. F. was a measurable success. The writer of this editorial (although a consultant himself) will go further and say that the consultant, though sometimes wrong and often misunderstood, was a necessary factor in what was accomplished both at the front and in base hospitals overseas. What was accomplished could not have been done without him.

Peace time organization and training of surgeons for military duty has even more to be said for it than military training of our youths in High Schools and Universities. Many of the shortcomings of surgeons in the military hospitals were due to inadequate peace time training and bad professional, (or unprofessional) habits acquired before the war. Training and organization for better military service might give us better service at all times. Dr. Brewer's plan will tend toward this.

Dr. Joel E. Goldthwait of Boston, chief consultant in Orthopedic Surgery, A. E. F., remarks in regard to the above that consultants for the different areas should be chosen on the basis of special training, age and physical fitness. The two latter qualifications must have special consideration for officers to be sent to the front. Dr. Nathaniel Allison of St. Louis, who was associated with Dr. Goldthwait and consultant to the First Army, points out the importance of having medical officers continue in the Reserve Officers Corps. Dr. Allison says, 'This must be done by all responsible surgeons who desire to influence preparedness for the medical service."

*The Duties and Responsibilities of the Civil Surgeon When Called to Active Military Service.—By George Emerson Brewer, M. D., of New York, N. Y. Annals of Surgery, Aug., 1920.

News Notes

The Canadian Department of Soldiers Civil Re-Establishment in Ottawa has just published an interesting and instructive pamphlet. This department with a smaller problem than the United States, has done in many respects, better work than ours. Those who saw the Orthopaedic Hospital in Toronto and the instructive film showing the work of some of the divisions were much impressed, not only with the fine service provided for care of the wounded in hospital, but for the progress made in real reconstruction and re-establishment of the wounded in civilian life.

Classes for Crippled Children.—The sum of $258,245 was requested for the classes for crippled children in the New York City public schools for 1921. This was reduced to $44,000, which was provided. The number of classes was reduced from thirty-six requested to nine. Provision was made for five additional classes for children with speech defects in the elementary schools. A class in each of the training schools for teachers, for the instruction of prospective teachers for correction of speech defects, was allowed. Medical Record, July 17, 1920.

Dr. Gustav Zander died recently at Stockholm. He was eighty-five years old.

Twenty-two Clinics for crippled children have been established in Illinois. Dr. C. W. East, head of the division of child hygiene of the state board of health is in charge of the work. The Clinics have a total attendance of 1,600.

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Current Orthopaedic Literature

THE RESULTS OBTAINED IN THE TREATMENT OF CHRONIC ARTHRITIS BY THE REMOVAL OF A DISTANT FOCUS OF INFECTION. Herbert Chapman. San Francisco.

A review of the status of focal infection and joint lesions, referring to work of Billings, Rosenow and others. The cases are divided into groups according to location of the focal infection. Fifty per cent of cases of chronic arthritis, treated at the Leland Stanford clinic, in which the removal of focal infections was done, were definitely improved as observed clinically. Twenty-one cases under personal observation of the author showed definite improvement in 76.2 per cent, no improvement was seen in 19 per cent, and 4.8 per cent were worse after treatment. The most striking results were obtained in the group of cases in which the focus of infection was in the genito-urinary tract, which need long and faithful treatment. In cases where the teeth were the location of the infection very rapid improvement was noted. Removal of the tonsils aided a small group of patients where tonsillectomy was indicated.—*Hall.*

SCIATICA FROM AN ORTHOPAEDIC STANDPOINT. *Medical Record.*

J. Appleton Nutter, after recounting very briefly some of the views regarding the origin of sciatica, and reporting four cases traceable to remediable orthopedic conditions, such as faulty posture, flat feet, arthritis deformans of the spine, cites other causes of the disease. Lesions of the hip-joint (among which arthritis deformans is the most commonly found); new growths; tuberculosis; injury of the bones of the lower spine or pelvis; multiple sarcomatosis with sciatica due to pressure in the pelvis; any form of pelvic disease capable of causing pressure on the sciatic nerve, to which may be added gravid uterus; psoas abscess; varicose veins inside the sheath of the nerve; syphilis, which is more likely to be present as a meningitis, as an arthritis of the lower spine, or as a periostitis, though true gummatous neuritis is possible; gonorrhea, acting commonly through the medium of an arthritis, though gonorrheal neuritis has been described; and variations in the lower spine may give rise to sciatica. In the differential diagnosis the writer warns of the pains of tabes. Sciatica is also fairly confused with hip-joint disease. It sometimes simulates the painful spasm of the peroneal muscles which so often accompanies a rigid flat foot. The pain seen in the calf of the leg which accompanies intermittent claudication has been mistaken for sciatica, as also that due to varicose veins. The treatment depends upon the cause. Tonsils, if diseased, may need removal, abscessed teeth may need extraction, a chronic prostatitis may need treatment. An arthritic spine needs fixation, a relaxed sacro-iliac joint should have efficient support, disease of the hip-joint calls for immobilization. All these measures will be found to have a marked effect upon the pain. For the affected

limb absolute rest is essential, pillow fixation as a rule being found useful. For the pain, acetyl-salicylic acid is useful, as also the salicylates and drugs of the coal-tar class, such as phenacetin. Counter-irritation over the course of the nerve is valuable. The Paquelin cautery is very useful and should be used only very superficially. The application of mustard and the use of blisters may give relief. The injection of sterile water, alcohol, or weak cocaine solution into or beside the nerve is not often practised, as permanent damage may be done. Nerve stretching is no longer in favor, and properly so in the writer's view. In subacute cases baking and massage will generally be found useful. Hydrotherapy is sometimes of value, but like electricity more often gives only temporary relief. The injection of sterile water into the epidural space of the sacral canal has given relief which has lasted several hours or even longer. It is a procedure easy of accomplishment and unlikely to result in damage to the nerve.

A Case of Snapping Knee (Genou a Tiroir.) R. Proust and R. Soupault. *Revue d'Orthopedie*, March 1920.

The authors' case, a man of 27, showed numerous deformities. He was afflicted with a deformity of the skeleton and the soft parts of the right forearm; with a fracture of the right humerus, the right femur and a backward dislocation of the left knee, all as a result of injury sustained nine years before. The knee presented normally no changes in contour; but it could without pain or force be brought into position of considerable genu valgum, whence it could be reduced under distinct cracking sound. In right angle flexion it could also be brought into position of backward dislocation and would snap back into normal position when the contracture of the flexors of the knee subsided. In extension the knee assumed the position of genu recurvatum.—*A. Steindler, Iowa City, Iowa.*

The Different Tendon Operations for the Relief of Permanent Partial or Total Musculospiral Paralysis. Mauclaire. *Revue d'Orthopedie*, April 1919.

The article contains a very complete synopsis of the different tendon operations in musculospiral palsy, beginning with the first tendon transplantation carried out by Drobnik in 1894.

The method of Sir Robert Jones is described more in detail.

Author's modification consists in volar incision in midline and detachment as low as possible of the following tendons: Flexor carpi radialis, Palmaris longus and Flexor carpi ulnaris; dorsal incision and, if necessary, plication of the extensor tendons; passing of flexor radialis and palmaris longus around the external and of the flexor ulnaris around the internal border of the forearm suture of the tendon of the Flexor ulnaris to the ulnar tendons of the extensor

digitorum communis, and of the tendons of the flexor radialis and palmaris longus to the radial tendons of the extensor communis.

According to this technique nothing is done to replace action of the extensors of the wrist.—*A. Steindler, Iowa City, Iowa.*

ANTERO-EXTERNAL DISLOCATION OF THE PATELLA. J. Murard. *Revue d'Orthopedie*, April 1919.

Following the report of a case the author, in discussing this condition calls attention to a number of interestng points. In order to bring about the dislocation a relaxation of the patellar tendon is necessary. This relaxation is furnished at the moment of the injury by the outward rotation of the leg on the thigh, or inward rotation of the knee. Another fact is the rotation of the patella which is explained by muscle action of the quadriceps at the moment of displacement. The reduction in the case reported was easy. It was carried out by direct manipulation, without force, by gentle pressure from outside inward. Late results of the reduction were not observed.—*A. Steindler, Iowa City, Iowa.*

TRAUMATIC LATERAL DISLOCATION OF THE SECOND LUMBAR VERTEBRA. REDUCTION BY TRACTION UNDER ANAESTHESIA. Guyot and Mauclaire. *Revue d'Orthopedie*, April 1919.

The authors report a case of traumatic dislocation of the second lumbar vertebra, sustained by a fall from a street car. The X-ray showed a complete lateral dislocation between the second and third vertebrae.

The right lower limb was totally paralysed, with hyperaesthesia most marked on the back of the foot, the anterior portion of the leg and thigh.

Plantar, Achilles and cremaster reflexes were absent.

On the left lower extremity, the motility of foot and leg were preserved, with a certain weakness of the extensor muscles of the leg. Plantar and cremaster reflexes were preserved, Achilles and knee reflexes absent.

The reduction was carried out under anaesthesia by both longitudinal and lateral traction, the longitudinal traction preceding, and being followed by lateral traction after ten minutes effort.

The very violent pain in the left lower extremity disappeared after reduction.

In the course of three to four months the right limb showed a marked return of motion in the extensors and flexors of the toes and abductors of the hip. On the left side motion had become normal. Sensibility on the right was normal to touch, and almost so to pain and heat. Reflexes were absent. On the left sensibility had become entirely normal, and reflexes were present with the exception of the plantar reflex.

The report is of considerable interest because of the completeness of the dislocation and the remarkable return of motor and sensory function. The low seat of the injury, below the level of the conus terminalis, involving only the nerve bundles of the cauda equina, accounts for the extraordinary result.—*A. Steindler, Iowa City, Iowa.*

TREATMENT OF SCOLIOSIS. E. Estor. *Revue d'Orthopedie*, April 1919.

The study of scoliosis which some years ago had commanded considerable interest has been practically abandoned during the war.

While the method inaugurated by Abbott has not quite justified its early expectations, yet it has taught us a number of important physiological facts and, with more or less modifications it is still finding followers among a number of orthopedists.

The author, reasoning from the transition of the physiological into the structural stage of scoliosis, adopts the forward flexion as a means of reducing deformity. In order to obtain the corrective effect of forward flexion the following exercises are advised:

1. Forward flexion of the trunk with extended knees, the fingers reaching within 10 cm. from the ground.

2. Elevation of the arm opposite the curve.

A platform mounted with a gaspipe frame is used for the maintenance of these positions.

In the subsequent application of the plaster cast the author follows essentially Abbott's technique. His observations are too recent to allow of definite conclusions. He is able to attest, however, that he has arrived with this method at results superior to any obtained heretofore.—*A. Steindler, Iowa City, Iowa.*

LUXATION IN THE FIRST TARSOMETATARSAL JOINT. By Reinhold Girgensohn. *Deutsche Zeitschr. f. Chir.*, Bd. 149, Heft ½., S. 135, 1919.

The literature of the dislocation of the first tarsometatarsal joint is reviewed and it is stated that only 26 cases have been reported.

The author adds his case to these statistics and gives the history as follows: A boy of 11 was riding horseback and fell together with the horse. The horse landed on his left foot and leg, and produced by the force of gravity the luxation in the tarsometatarsal joint. Reposition was impossible and extirpation of the internal cuneiform became necessary. The foot was immobilized. The result was perfect.

In nearly half of the cases a fall from and with the horse was given as etiology, because only through an excessive action of force is the production of this dislocation possible. This force acts in a longitudinal direction to the metatarsal bone. While the thrown off rider rests on the ground on all fours; forearms and hands in front, knees and balls of the big toes behind, the fall-

ing horse strikes the foot and presses it in the direction of the long axis of the first metatarsal. The metatarsal dislocates, in most of the cases, dorsally; in a few cases the internal cuneiform breaks or becomes crushed.

Reposition of the dislocated metatarsal is simple if no cuneiform fracture has occurred; in the latter case the cuneiform must be extirpated before reduction is possible.

The prognosis is good, as a rule. Perfect anatomical and functional result is obtained, provided the foot is early mobilised.—*A. Gottlieb, M. M., San Francisco, California.*

ON THE SUNLIGHT TREATMENT OF SURGICAL TUBERCULOSIS. By C. Bruening. *Dtsch. med. Woch.*, 1920, No. 1.

Under the most favorable conditions for heliotherapy, the author has made observations which are of value as a contribution to the teachings of Rollier of Leysin (Switzerland). In a hospital in Constantinople which was located on the seashore where the air was permanently clear, the sun constantly shining with intensity, the author has had excellent conditions for this treatment and an abundance of material. The results, in bone and joint-tuberculosis were however discouraging. Contrary to Rollier, Bruening has treated almost entirely adults, only very few children were under his observation. Further, these adults were undernourished and in a poor state of general health.

The author comes to the conclusions that heliotherapy is a valuable adjunct in the treatment of tuberculosis, but that it should not be regarded as an "all-healing measure," which makes the other, known and recognised, measures unnecessary; that sufficient nourishment is of much higher importance in the healing of tuberculous processes and that the air in a high altitude is more valuable than the rays of the sun. Heliotherapy may be regarded as a contributory aid in the fight against tuberculosis but its value must not be overestimated.—*A. Gottlieb, M. D., San Francisco, California.*